A PRELIMINARY ACCOUNT OF THE COLLEMBOLA-ARTHROPLEONA OF AUSTRALIA.

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PART I.—SUPERFAMILY PODUROIDEA.

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That the Collembola as a whole, and this superfamily in particular, has received very little attention from entomologists in Australia is doubtlessly due to their small size and to the supposed lack of economic importance.

Most of the species recorded and described in this paper were collected by the writer while working in Western Australia as an officer of the Commonwealth Council for Scientific and Industrial Research.

In addition, very great help and encouragement have been received from Dr. R. J. Tillyard and other friends who have collected material in other States and forwarded it for identification and study. To all these the writer tenders his deepest thanks. All such records are acknowledged by placing the collector's initials after the particular record.

Three species of this superfamily were described in 1899 by Sir J. Lubbock as from Tasmania (168). His names for these were *Anoura tasmaniae, A. dendyi,* and *A. spinosa.* In 1906, Börner placed the last two species in new genera and left the first in the genus *Achorutes* Temp., which had replaced *Anoura.* Börner's names for the first two species were *Acanthanura dendyi* and *Holacanthella spinosa* (38). In 1925, Dr. G. H. Carpenter (Mem. & Proc. Manchester Lit. and Phil. Soc., vol. lxix.), while describing some Collembola from New Zealand showed that Lubbock's species had been erroneously recorded from Tasmania, and that they had been found in New Zealand.

The first authentic record, then, of species of Collembola belonging to this superfamily occurring in Australia would appear to be that of J. W. Rainbow (198) in 1907. In that paper the author described two new species, *Achorutes speciosus* and *Isotoma troglodytica,* from New South Wales. Through the courtesy of the Curator of the Australian Museum at Sydney, the writer has been able to examine the type slides of Rainbow's material, and it is now shown that these two species are synonymous with earlier known European species, namely *Xenylla mucronata* Axelson and *Proisotoma minuta* (Tullberg). The second species belongs to the superfamily Entomobryoidea, and will be dealt with in a later paper.

In 1917, Schött (226), in his paper on the Collembola collected in Australia by the Mjöberg Swedish Expedition of 1910-13, recorded only the following five species:—*Hypogastrura armata* (Nicolet), *Pseudachorutes incertus* Schött, *Ceratrimeria maxima* (Schött), *Achorutes rosaceus* Schött, *Achorutes cirratus* Schött.

In this paper further records are given for four of Schött's species as well as *Xenylla mucronata;* in addition 24 species are added to the list, making a total of 30 species of Poduroidea now known to occur in Australia. The full list is as follows:—**Hypogastrura armata* (Nicolet); **H. manubrialis* (Tullberg); **H. manuubrialis* var. *neglectus* Börner; **H. purpurascens* (Lubb.); **H. pseudo-purpurascens* Womersley; **Xenylla maritima* Tullberg; **X. grisea* Axelson; *X. littoralis,* n. sp; *X. occidentalis,* n. sp.; **X. mucronata* Axelson; **Friesia mirabilis* (Tullberg); *Ceratrimeria maxima* (Schött); **Odontella lamellifera*

(Axelson); *Pseudachorutes incertus* Schött; **P. rhaeticus* (Carl); **Brachystomella parvula* (Schäffer); *B. fungicola,* n. sp.; *B. afurcata,* n. sp.; *B. acantha,* n. sp.; *B. anomala,* n. sp.; **Anurida granaria* (Nicolet); *Neachorutes glauerti,* n. gen., n. sp.; *Achorutes rosaceus* Schött; *A. cirratus* Schött; *A. hirtellus* Börner; *A. newmani,* n. sp.; **Onychiurus fimetarius* (Linn., Lubbock); **O. ambulans* (Linn., Tullberg); **O. armatus* Tullberg; *Tullbergia trisetosa* (Schäffer); *T. australis,* n. sp. Of this number nine species and one genus are new to science, and no fewer than 15 species and one variety are well-known European forms. The latter are marked by an asterisk.

Economic Importance of the Poduroidea.

Although considerable attention is being focussed on the economic importance of certain Collembola belonging to the family Sminthuridae, little notice appears to have been taken of the species discussed in this paper.

The attention of economic entomologists was first directed to the Collembola by Dr. G. H. Carpenter (68) in 1905, when he recorded *Hypogastrura (Achorutes) armata* (Nicolet) and *Onychiurus (Lipura) ambulans* (Linn., Lubbock) as attacking bean seeds, and *H. (A.) armata* and *H. (A.) longispina* (Tullberg) as occurring on fruit lying on the ground.

In 1911, before the First International Congress of Entomology, held at Brussels, F. V. Theobald (241) surveyed the recorded instances of damage due to species of Collembola. He enumerated 23 species, of which 20 are at present regarded as valid, the remainder being synonyms. Representatives of the Poduroidea in Theobald's list number eight, five of which occur in Australia. These species are:—*Hypogastrura (Achorutes) armata* (Nicolet), *H. (A.) manubrialis* (Tullberg), *H. (A.) longispina* (Tullberg), *H. (A.) purpurascens* (Lubbock), *H. (A.) rufescens* (Nicolet), *Onychiurus (Lipura) armata* (Tullberg), *O. (L.) ambulans* (Linn., Tullberg), *O. (L.) fimetarius* (Linn., Lubbock), *Kalaphorura (Lipura) burmeisteri* (Lubbock).

In addition he gave the following personal observations of damage by these small insects:—1. *H. (A.) purpurascens* (Lubbock) on cabbages; 2. *H. (A.) rufescens* (Nicolet) damaging mushrooms; 3. *O. (L.) ambulans* (Linn., Tullberg) attacking celery, cauliflower, sea kale and asparagus; 4. *O. (L.) fimetarius* (Linn. Lubbock) attacking strawberry plants.

In 1906 W. E. Collinge (82) recorded *O. (L.) ambulans* on bulbs damaged by eel-worm, and *H. (A.) armata* from nursery gardens in Birmingham, England In his "Manual of Injurious Insects" (82) the same author proves that Collembola are often the primary cause of injury to orchids, bulbs, beans, peas, and fruit trees, the resultant injuries allowing the access of fungal spores, thus leading to subsequent decomposition of the plant tissues. Recently three species of *Onychiurus* have been described from Japan by J. Matsumota and T. Satto (177) as occurring on and damaging wheat.

Apart from feeding on foliage and decaying organic matter, the members of this superfamily of Collembola are often found inhabiting the gills of various fungi, and in microscopic mounts the intestines are often found to contain fungal spores. From this it follows that even if the initial damage caused by these insects is not of itself great, yet they may readily be the cause of more serious and extensive harm.

In addition, while many of the species are essentially soil feeders, they will also attack the young roots and rootlets of plants. If present in large numbers, as they often are, this may lead to serious harm and even death of the plants.

On the other hand, at least one species, *Hypogastrura viatica* (Tullberg) has been shown to be of considerable industrial use (29). It can be used to clean automatically the top of sewage filter beds from the growths of algae, which other-

wise interfere with the proper working and neeessitate periodical stoppage for its removal.

While the reeorded cases of damage by this group of Collembola may be eonsidered as slight, it must always be kept in mind that those speeies which are now shown to occur in Australia, probably as introduetions, may, under the more suitable elimatic eonditions, become major pests and cause extensive and widespread damage as in the case of the Clover Springtail.

Collembola-Arthropleona Börner, 1901.

This suborder of the Collembola, which eomprises all those forms with elongate bodies, has been divided by Börner (44) into two superfamilies which he ealls Entomobryomorpha and Poduromorpha. As these names are decidedly cumbersome, it would seem better to follow the suggestion of Dr. R. J. Tillyard and adopt the eustomary superfamily ending "oidea."

The two families are separated thus:—

1. (2) Prothorax free, similar to the other thoracic segments, furnished with hairs, not hidden under mesothorax. Cuticle mostly granular, in some cases with pseudocelli. Antennae short, 4-segmented.
   Superfamily Poduroidea
   = Poduromorpha Börner, 1913

2. (1) Prothorax not haired, more or less hidden under mesothorax. Cuticle smooth, haired or scaled. Antennae long, 4-6-segmented.
   Superfamily Entomobryoidea
   = Entomobryomorpha Börner, 1913

Superfamily PODUROIDEA.

Family HYPOGASTRURIDAE Börner, 1913.

Syn.=*Achorutini* Börner, 1901 (ad partem); *Achorutinae* Börner, 1901 (ad partem); *Hypogastrurinae* Börner, 1906.

Genus Hypogastrura Bourlet, 1839; Börner, 1906.

Syn.=*Podura* Linne, 1746 (ad partem); *Achorutes* Templeton, 1835 (ad partem); *Hypogastrura* Bourlet, 1839; *Achorutes* Tullberg, 1872; *Schöttella* Sehäffer, 1896.

Subgenus Hypogastrura s. str. Börner, 1906; Linnaniemi, 1912.

Syn.=*Achorutes* Schäffer, 1896 (ad partem); *Achorutes* Börner, 1901 (ad partem); *Hypogastrura* s. str. Börner, 1906 (ad partem).

Hypogastrura armata (Nicolet).

(Text fig. 1, *a-c.*)

Podura armata Nicolet, 1841; *Achorutes armatus* Tullberg, 1871; *Achorutes boletivorus* Packard, 1873; *Achorutes texensis* Paekard, 1873; *Achorutes pratorum* Packard, 1873; *Achorutes marmoratus* Packard, 1873; *Achorutes filiformis* Wahlgren, 1906; *Hypogastrura armata* (Axelson) Linnaniemi, 1911.

Description—Length, 1·5-2·0 mm., with moderately long dorsal setae, often serrated. Ocelli, eight on each side on black patches. Postantennal organ with four unequal peripheral lobes. Antennae shorter than head. An exsertile sae between third and fourth antennal segments. Fourth antennal segment with 7 olfactory hairs and an apieal knob. Claws slender, with inner tooth near the middle and a lateral outer tooth. Empodial appendage with basal lamella and

apical spine which often reaches tip of claw. One long tibio-tarsal hair present, which is not clavate. Dens twice as long as mucro. Mucro apically rounded, outer lamella with deep incision and tooth-like lobe. Anal spines longer than

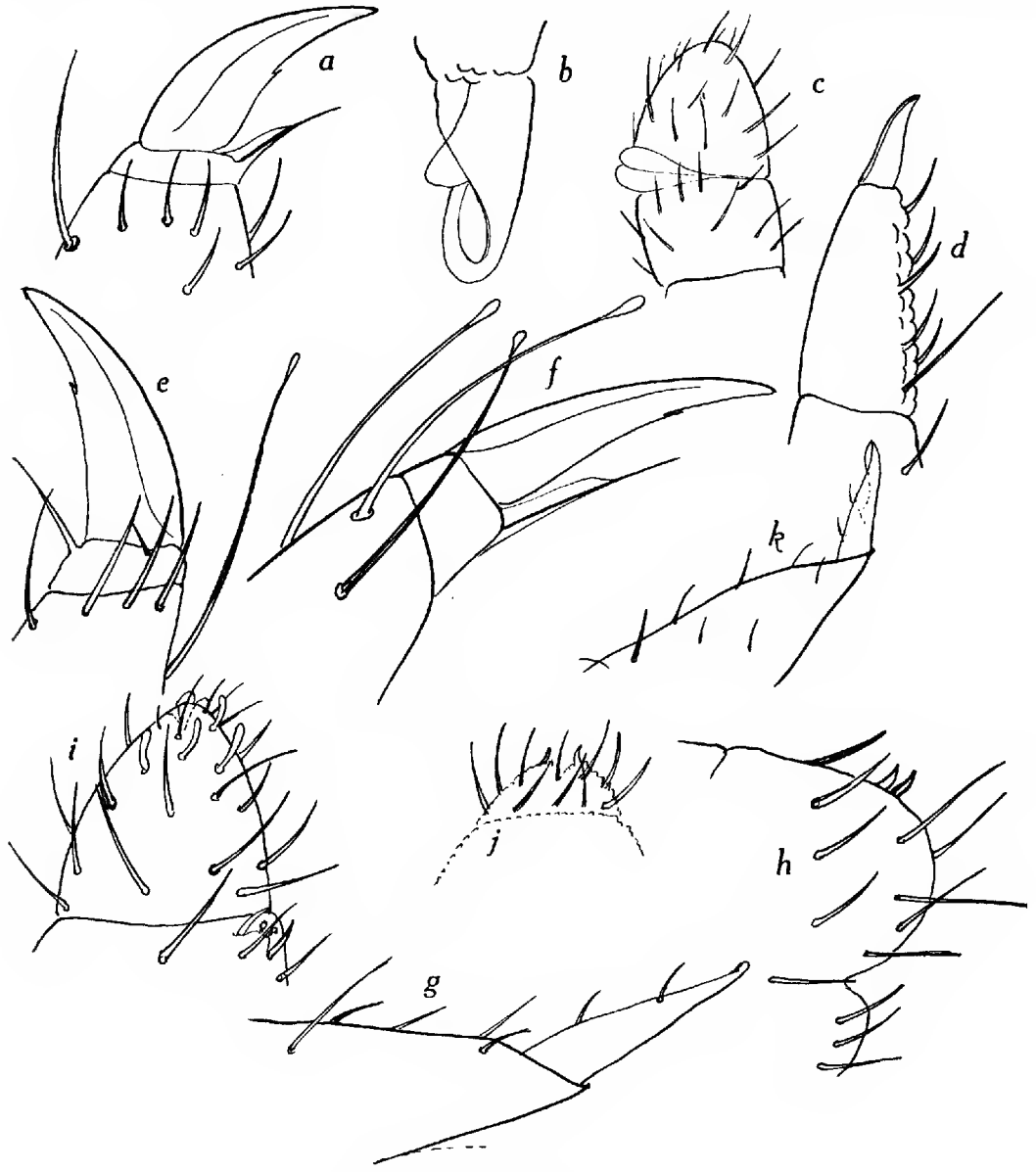

Fig. 1.

a. *Hypogastrura armata* (Nicolet). Claw and tip of tibiotarsus.
b. „ „ „ Mucro from side.
c. „ „ „ Antennae III. and IV.
d. „ *manubrialis* (Tullberg). Mucro and dens from side.
e. „ „ „ Claw and tip of tibiotarsus.
f. „ *pseudopurpurascens* Womersley. Claw and tip of tibiotarsus.
g. *Xenylla maritima* Tullberg. Furca from side.
h. „ „ „ Anal segment.
i. „ *grisea* Axelson. Antennae IV. and apex of III.
j. „ „ „ Anal segment from above.
k. „ „ „ Furca from side.

claws, narrow, curved and placed on papillae which touch at their base. Colour variable, from brownish to blackish.

Three varieties of this species are recognised and can be separated by the following key:—

1. (4) Anal spines present.
2. (3) Bristle of empodial appendage reaching beyond tip of claw and apically bent.—*H. armata* var. *cuspidata* Axelson.
3. (2) Bristle of empodial appendage straight and only reaching tip of claw.—*H. armata* (Nicolet) *forma principalis.*
4. (1) Anal spines absent.—*H. armata* var. *inermis* Axelson.

This almost cosmopolitan species was first recorded from Australia in its typical form by Schött in 1917 (226). This form is, however, generally widely distributed, and the writer has seen specimens from the following localities:—Adelaide, S. Aust. (no date, in S.A. Museum collection); Urrbrae, Adelaide, S. Aust., October, 1929 (Waite Institute); Perth, W. Aust., October 4, 1930; Guildford, W. Aust., October 6, 1930; Albany, W. Aust., October 17, 1930; Claremont, W. Aust., December 19, 1930; Belgrave, Vict., April 19, 1931 (H. F. D.); Sherbrook, Vict., April 19, 1931 (H. G. A. & H. F. D.); Studley Park, Vict., August, 1931 (H. G. A.); Pinjarra, W. Aust., September 29, 1931 (D. C. S.).

Var. Inermis Axelson.

Studley Park, Vict., August 1931 (H. G. A.); Woodside, S. Aust., July, 1933 (H. W.).

Hypogastrura manubrialis (Tullberg), 1869.

(Text fig. 1, *d-e.*)

Achorutes manubrialis Tullberg, 1869; *Achorutes Schötti* Reuter, 1895; *Achorutes assimilis* Krausbauer, 1898; *Achorutes neglectus* Börner, 1901.

Description.—Length to 1·5 mm. Colour blackish-brown to grey-blue, mottled. Hairs short curved. Antennae shorter than head. Antennae IV. with 4 olfactory hairs. No eversible sack between antennae III. and IV. Postantennal organ with five peripheral lobes. Claw without inner tooth, with basal lateral tooth. Empodial appendage filiform, with basal lamella. Tibiotarsal tenent hair only indistinctly clavate. Mucro two-thirds as long as dens. Dens ventrally tuberculate. Mucro narrow, with simple or curved apex and simple lamella. Anal spines very small, on separated papillae.

The following varieties are recognised:—

1. (4) With anal spines and papillae.
2. (3) Mucro long and pointed with very narrow lamella. Blackish-brown.—*H. manubrialis* (Tullberg) *forma principalis.*
3. (2) Mucro broad with broader lamella.—Var. *assimilis* (Krausbauer).
4. (1) No anal spines or papillae.—Var. *neglectus* (Börner).

Localities.—Forma principalis: South Perth, W. Aust., June 28, 1928 (K. C. R.); Perth, W. Aust., August, 1931; Urrbrae, Adelaide, S. Aust., July, 1930 (Waite Institute). Var. *neglectus* (Börner): Adelaide, S. Aust. (in S.A. Museum collection, without date).

Hypogastrura purpurascens (Lubbock), 1868.

Hypogastrura purpurascens Linnaniemi, 1912 (ad partem).

Description.—Length, 2·0 mm. Colour very variable but mostly blue-black. Hairs short and sparse. Ocelli, 8 on each side on dark patches. Postantennal organ with 4-5 peripheral lobes and central boss. Antennae IV. with olfactory

hairs. No eversible sac between antennae III. and IV. Claw with subapical inner tooth. Empodial appendage with broad inner lamella. Tibiotarsus with 2-3 clavate hairs in a transverse row. Furca with apical hook and distinct narrow lamella to the mucro. Anal spines small, curved, one-fourth as long as hind claw and on rather long papillae.

In the S.A. Museum is a tube of specimens of this species taken in Adelaide, but without data.

HYPOGASTRURA PSEUDOPURPURASCENS Womersley.

(Text fig. 1, *f*.)

Hypogastrura purpurascens Linnaniemi 1912 (ad partem).

This species was separated from the European *H. purpurascens* Lubbock (265) on the relative disposition of the clavate tibiotarsal hairs, colour, and habitat. In Lubbock's species the clavate tibiotarsal hairs are placed in a transverse line, whereas in this species the lateral hairs are twice as far from the apex as the medial one. The insects are usually of a brownish mottled colour and do not appear to assume the blue-black of typical *purpurascens*. In habitat it appears to be confined to the crevices of rotten bark rather than to damp walls. In his valuable monograph Linnaniemi (158) alludes to this difference in the arrangement of the tibiotarsal hairs, but has apparently not appreciated its importance.

Australian localities for this species are:—Bridgetown, W. Aust., November 3, 1930; Belgrave, Vict., April 19, 1931 (F. H. D.); Sherbrook, Vict., April 19, 1931 (H. G. A.).

Genus XENYLLA Tullberg, 1869.

XENYLLA MARITIMA Tullberg, 1869.

(Text fig. 1, *g-h*.)

Xenylla brevicauda Reuter, 1895.

Description.—Length, 1·5 mm. Colour, grey-blue to black. Antennae shorter than head, IV. with 3-4 olfactory hairs. Claws without inner teeth. Clavate hairs on tibiotarsi 1 to 2. Mucro fused to dens, with apical hook and narrow lamella. Anal spines small on broad adjacent papillae. Ocelli, 5 on each side. Clothing sparse, of curved, seldom serrated hairs.

This is a well-known European species which has not previously been recorded from Australia. The writer has seen specimens from the following:—Perth, W. Aust., November 24, 1930; same, May 23, 1931; Studley Park, Vict., August, 1931 (H. G. A.); Denmark, W. Aust., October, 1931.

XENYLLA GRISEA Axelson, 1900.

(Text fig. 1, *i-k*.)

? *Xenylla gracilis* Guthrie, 1903.

Description.—Length, 1·2 mm. Colour, grey; seldom bluish. Hairs long and outstanding. Cuticle granular. Antennae two-thirds as long as head, IV. with 4-5 olfactory hairs. Claw toothless. Tibiotarsus with 2 clavate hairs. Furca short and strong. Mucro with broad inner lamella and curved hook-like apex. Anal spines 2, large, on adjacent papillae.

This is a well-known European species. It occurred on decaying bulbs at Claremont, W. Aust., March 3, 1931.

Xenylla littoralis, n. sp.

(Text fig. 2, *a-f*.)

Description.—Length, 1·4 mm. Colour, dark brownish to blue-black. Antennae three-fourths as long as head, ratio of segments I. : II. : III. : IV. =

20 : 20 : 20 : 20, IV. with approximately 4 olfactory hairs, III. with the usual form of sensory organ. Ocelli, 5 on each side on black patches. Postantennal organ absent. Claw with strong inner tooth just beyond the middle. Empodial appendage absent. Tibiotarsus with 2 clavate hairs reaching tip of claw. Furca long, mucro distinctly separated from dens, tapering to a fine point and with narrow entire inner lamella, mucro slightly longer than dens. Dens with two inner setae. Anal spines minute, on papillae of their own length, bases of papillae not touching. Ratio of mucrodens : tibia III. : claw III. = 5 : $3\frac{1}{4}$: 2. Clothing of fairly numerous short setae, slightly longer analwards.

This species appears to be of truly littoral habitat. It occurs under stones between high and low tide marks along the coast along with *Neachorutes*

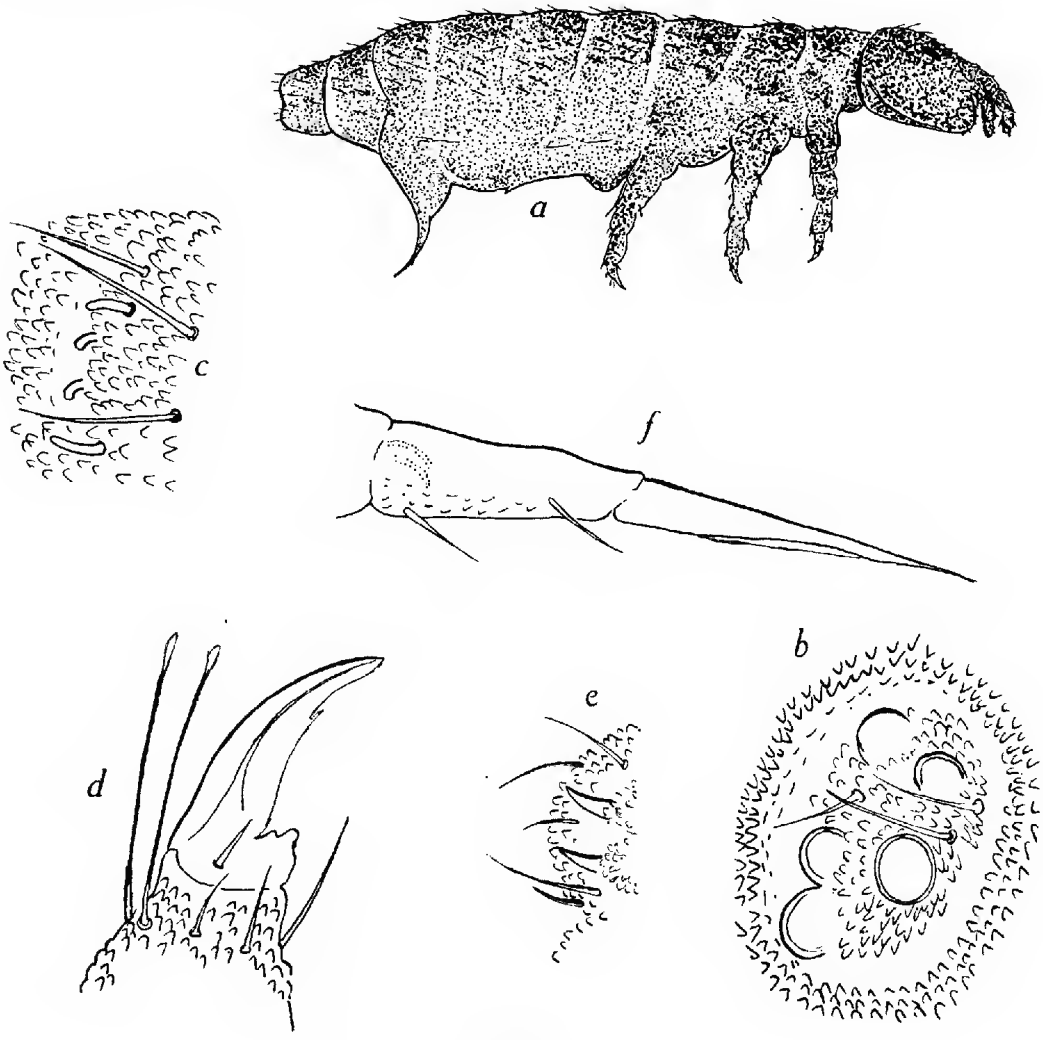

Fig. 2.

Xenylla littoralis, n. sp.

a. Lateral view of entire insect.
b. Ocellar field.
c. Sensory organ on antennae III.
d. Claw and tip of tibiotarsus.
e. Anal spines.
f. Furca from side.

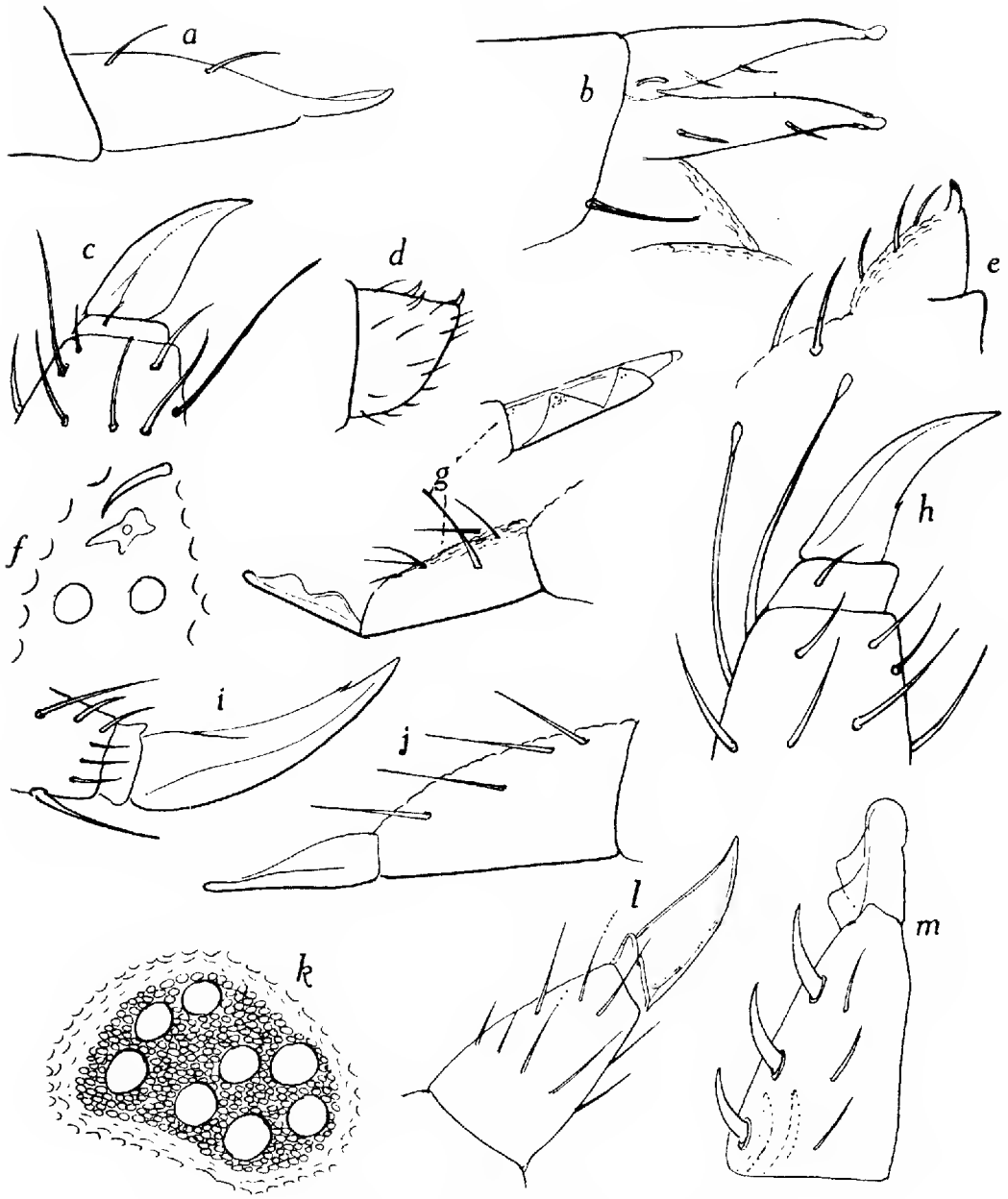

Fig. 3.

a. *Xenylla mucronata* Axelson. Mucrodens from side.
b. „ *occidentalis*, n. sp. Furca.
c. *Friesea mirabilis* (Tullberg). Claw and tip of tibiotarsus.
d. „ „ „ Anal segment from side.
e. „ „ „ Furca from side.
f. *Odontella lamellifera* Axelson. Anterior ocelli and postantennal organ.
g. „ „ „ Furca from side and another view of mucro.
h. „ „ „ Claw and tip of tibiotarsus.
i. *Pseudachorutes rhacticus* Carl. Claw and tip of tibiotarsus.
j. „ „ „ Furca from side.
k. *Brachystomella acantha*, n. sp. Ocellar field.
l. „ „ „ „ Tibiotarsus and claw.
m. „ „ „ „ Mucro and dens from side.

glauerti, n. sp., and *Axelsonia littoralis* Moniez. It was first obtained by Mr. L. J. Glauert from Rottnest Island, Western Australia. Its nearest allies appear to be *X. longicauda* Fols. from Japan and *X. orientalis* Handschin from the Dutch Indies. From the first it differs in the presence of an inner tooth to the claw and in having anal spines. From the latter the form of the mucro is distinct.

Localities.—Rottnest Island, W. Aust., January 31, 1931 (L. J. G.); Christy's Beach, Port Noarlunga, S. Aust., January 17, 1932 (D. C. S.).

Xenylla mucronata Axelson, 1903.

(Text fig. 3, *a*.)

Achorutes speciosus Rainbow, 1907.

Description.—Length, 1·3 mm. Colour, bluish. Claws small, with small inner tooth. Furca narrow, mucro separated from dens.

Through the kindness of the Curator of the Australian Museum, Sydney, the writer has been able to examine the type slide of Rainbow's species. This has revealed the fact that *speciosus* Rainbow is but a synonym of *mucronata*. The statement by Rainbow that the eyes in his species number eight on each side is erroneous. Actually there are only five, which is the normal number for the genus *Xenylla*. Possibly the dark pigmentation of the eye-patch misled him. The absence of the empodial appendage also confirms it as a *Xenylla*.

Localities.—Bathurst, N.S.W., 1907 (Rainbow); You Yang Mountains, Vict., September 24, 1931 (Miss J. W. R.); Kenwick, W. Aust., April 4, 1932 (H. W.).

Xenylla occidentalis, n. sp.

(Text fig. 3, *b*.)

Description.—Length, 0·6 mm. Colour, dark brownish. Antennae rather more than half as long as head, ratio of segments I. : II. : III. : IV. = 7 : 7 : 9 : 11, IV. with at least 4-5 olfactory hairs, sensory organ on ant. III. probably normal but indeterminate. Ocelli, 5 on each side on dark patches. Postantennal organ absent. Claws apparently without inner teeth. Empodial appendage absent. Two clavate tibiotarsal hairs. Furca strong, mucro short only about one-fifth the length of dentes, with broad lobe-like appearance, dens with two inner setae. Anal spines very minute, scarcely more than enlarged granulations of the cuticle. Tenaculum with 3 barbs. Mucro four times as long as hind claw.

This species is very distinctive in the structure of the mucro and cannot be confused with any other described species. It has been taken as follows:—Red Hill, W. Aust., August 27, 1931, in fungus (D. C. S.); Kalamunda, W. Aust., May 30, 1931, in fungus (D. C. S.).

Genus Friesea Dalla Torre, 1895.

Syn. = *Triaena* Tullberg, 1871; *Macgillivraya* Grote, 1894.

Friesea mirabilis (Tullberg), 1871.

(Text fig. 3, *c-c*.)

Triaena mirabilis Tullberg, 1871.

Description.—Length, 1·0 mm. Colour, grey-blue, mottled. Antennae shorter than head, IV. with 4-5 olfactory hairs. Claws toothless. Empodial appendage present, without terminal seta. No clavate tibiotarsal hairs. Furca very small, mucro represented only by a hook. Anal spines three, occasionally four, on small papillae. Body hairs not clavate.

A single specimen of this European species was found along with *Xenylla grisea* Axelson, on decaying bulbs at Claremont, W. Aust., March 19, 1931.

Several specimens, including one of the form *quadrispina* Axelson with four anal spines, were taken in garden soil by means of the Berlese funnel at Glen Osmond, South Australia, March, 1933.

Genus CERATRIMERIA Börner, 1906.

CERATRIMERIA MAXIMA (Schött).

Schöttella maxima Schött, 1901.

Description.—Length, 2·5 mm. Colour, grey-blue with light stripes, ventral surface whitish. Body stumpy, segments dorsally with prominent pleural areas. Antennae short, segments III. and IV. indistinctly separated, IV. with trilobed terminal organ. Ocelli, 8 on each side. Postantennal organ half elliptical with about 30 tubercles. Mouth parts suctorial. Integument with hexagonal areas. Claws broad with lateral lamellae, with large lateral teeth. Empodial appendage absent. Anal spines absent.

This interesting species was recorded from Queensland by Schött (226) in 1917. The writer has had specimens from Belgrave, Vict., April 19, 1931 (H. F. D. & H. G. A.); Sherbrook Falls, Vict., April 19, 1931 (H. G. A.).

Genus ODONTELLA Schäffer, 1897.

Syn. = *Xenyllodes* Axelson, 1903 (ad partem).

ODONTELLA LAMELLIFERA Axelson, 1903.

(Text fig. 3, *f-h.*)

Xenyllodes lamellifera Axelson, 1903; *Odontella suecia* Wahlgren, 1906.

Description.—Length, 1·3 mm. Colour, blue-grey with distinct mottlings. skin richly tuberculate. Hairs short and sparse. Antennae shorter than head. segment IV. with curved olfactory hairs. Ocelli, 5 on each side. Postantennal organ with 4 peripheral lobes in a groove. Claw toothless. Tibiotarsi with two simple spur hairs. Mucro equal to dens in length, with two characteristic lobes on inner lamella. Anal horns about equal in size to the cuticular granules, two in number.

This is a rare species, hitherto known only from Northern Europe. It is, therefore, of much interest that it should be found in Australia. It was obtained from the following localities by means of the Berlese funnel:—Sherbrook Falls, Vict., April 19, 1931 (H. G. A.); Belgrave, Vict., April 19, 1931 (H. F. D.).

Genus PSEUDACHORUTES Tullberg, 1871.

Syn. = *Schöttella* Schäffer, 1896 (ad partem).

PSEUDACHORUTES RHAETICUS (Carl), 1899.

(Text fig. 3, *i-j.*)

Schöttella rhaetica Carl, 1899.

Description.—Length, 1·5-3·0 mm. Colour, dark brown to black. Antennae with trilobed apical knob and 3-4 olfactory hairs on segment IV. Postantennal organ with 12-15 peripheral lobes. Claw toothless, seldom with small inner tooth and lateral tooth. Clavate tibiotarsal hairs and anal horns absent. Dens somewhat swollen and with strong tubercles. Mucro straight dorsally, apex curved, lamella with notched edge. Hairs short and sparse. Mandibles present and needle-like.

This species is markedly distinct from the only true species of this genus known from Australia, namely *P. incertus* Schött. It can now be recorded from the following places:—Parkerville, W. Aust., October 5, 1930 (H. W.); Belgrave,

Vict., April 19, 1931 (H. G. A.); Sherbrook, Vict., April 19, 1931 (H. G. A. & H. F. D.); You Yang Mountains, Vict., September 24, 1931 (Miss J. W. R.); Sassafras, Vict., December, 1931 (H. G. A.).

Genus Brachystomella Agren.

Syn. = *Schöttella*, Schäffer, 1896 (ad partem); Schtscherbakow, 1899 (ad partem); Carl, 1901 (ad partem); Sehött, 1902 (ad partem). *Brachystomella*, Agren, 1903; Stach, 1929. *Schöttelodes* Becker, 1905. *Chondrachorutes* Wahlgren, 1906; Denis, 1924.

In 1929 Stach (238) restudied the species *Schöttella parvula* Schäffer, as well as all the then known allied species. He went into the position very thoroughly and showed that Schäffer's species belonged to the genus *Brachystomella* of Agren, which differed very definitely from *Pseudachorutes* s. str. in the entire absence

Fig. 4.

a. *Brachystomella parvula* (Schäffer). Sensory organ on antennae III.
b. „ „ „ Anterior ocelli and postant. organ.
c. „ „ „ Claw and tip of tibiotarsus.
d. „ „ „ Mucrodens.
e. „ *fungicola*, n. sp., Head of maxilla.
f. „ „ „ „ Antennae IV. and tip of III.
g. „ „ „ „ Anterior ocelli and postant. organ.
h. „ „ „ „ Claw and tip of tibiotarsus.
i. „ „ „ „ Mucro from side.
j. „ *afurcata* „ „ Apex of antennae IV.
k. „ „ „ „ Sensory organ of antennae III.
l. „ „ „ „ Anterior ocelli and postant. organ.
m. „ „ „ „ Head of maxilla.
n. „ „ „ „ Claw and tip of tibiotarsus.

of mandibles. In the place of these organs, the heads of the maxillae are modified by being strongly toothed.

BRACHYSTOMELLA PARVULA (Schäffer), 1896.
(Text fig. 4, *a-d.*)

Schöttella parvula Schäffer, 1896; *Schöttella media* Axelson, 1900; *Chondrachorutes wahlgreni* Denis, 1924; *Schöttella minor* Schtscherbakow, 1899; *Schöttella albomaculata* Carl, 1901; *? Schöttella crassicornis* Schött, 1902; *? Brachystomella maritima* Agren, 1903.

Description.—Of *Pseudachorutes* build. Length, 1·0 mm. Colour, brownish, mottled. Ocelli, 8 on each side. Postantennal organ with 5-6 peripheral lobes. Tibiotarsi with 2-3 long hairs, not clavate or only indistinctly so. Claws with inner tooth. Mucro short and tapering. Dens with 5-6 setae. Mandibles wanting, maxillae with broad, toothed head.

This European species appears to be common and widely distributed throughout the southern part of Australia. Specimens have been seen from the following localities:—Corney Point, S. Aust., date? (M. Klem); South Perth, W. Aust., June 28, 1926 (K. O. R.); Beverley, W. Aust., October 2, 1930 (H. W.); Nangara, W. Aust., November 11, 1930 (B. A. O'C.); Crawley, W. Aust., May 14, 1931 (H. W.); National Park, W. Aust., September 3, 1931 (D. C. S.); Mandurah, W. Aust., April 29, 1931 (H. W.); Queenwood, Preston Valley, W. Aust., June 12, 1931 (H. W.); Encounter Bay, S. Aust., May, 1929 (J. B. C.); Urrbrae, Adelaide, S. Aust., 1930 (Waite Institute); Studley Park, Vict., August, 1931 (H. G. A.).

Brachystomella afurcata, n. sp.
(Text fig. 4, *j-n.*)

Description.—Length, 1·2 mm. Colour, bluish-black. Antennae slightly shorter than head, ratio of segments I. : II. : III. : IV. = 8 : 8 : 10 : 12, III. and IV. only indistinctly separated, IV. with trilobed apical knob and 4-5 olfactory hairs, antennal organ III. as figured. Ocelli 8 on each side on a dark field. Postantennal organ with 5 peripheral lobes as figured. Mandibles absent, head of maxillae broad and toothed. Claws without teeth. Tibiotarsus with 3 strongly clavate hairs, one subapical and outside, two inside and more proximal. Furca absent. Clothing of sparse but fairly long and fine setae.

This species is closely related to *B. parvula* Schäffer, but differs in the absence of the furca and the strongly clavate tibiotarsal hairs.

Localities.—Beverley, W. Aust., June 4, 1931 (H. W.); Pine Island, Murrumbidgee River, F. C. T., June, 1931 (R. J. T.); Red Hill, W. Aust., August 27, 1931 (D. C. S.).

Brachystomella acantha, n. sp.
(Text fig. 3, *k-m.*)

Description.—Length, 0·9-1·0 mm. Colour, yellowish. Head and antennae bluish, eye patches black. Antennae slightly shorter than the head, ratio of segments I. : II. : III. + IV. = 10 : 10 : 20, IV. with trilobed apical knob, organ on ant. III. indeterminate. Ocelli, 8 on each side on black patches. Postantennal organ wanting. Claws strong without inner teeth. No clavate tibiotarsal hairs. Empodial appendage wanting. Mandibles wanting. Head of maxillae as in genus. Furca small, dens twice as long as mucro with three strong, curved spines on ventral aspect, mucro with inner and outer lamellae with lobes, apex of mucro rounded. Clothing of sparse, short fine hairs. Cuticle finely granular.

This rather small but strikingly distinct species was found in numbers in a species of *Boletus* at Crawley, Western Australia, May, 1931 (D. C. S.) along with *Brachystomella fungicola,* n. sp.

Brachystomella fungicola, n. sp.

(Text fig. 4, *c-i.*)

Description.—Length, to 3·5 mm. Colour, brownish, lighter ventrally. Antennae as long as head, ratio of antennal segments I. : II. : III. : IV. = 30 : 35 : 25 : 35, segments III. and IV. indistinctly separated, IV. with trilobed apical knob and 2 (?) olfactory hairs, III. with organ as figured. Ocelli, 8 on each side on a dark field. Postantennal organ with 4 peripheral lobes. Mandibles wanting. head of maxillae as figured. Tibiotarsi without clavate hairs. Claws strong with inner tooth. Empodial appendage absent. Furca well developed, dens broad and tuberculate and twice as long as mucro, mucro with inner and outer lamellae, basally granular. Cuticle finely granular and clothed with fine and short but sparse hairs.

This species is very distinctive in the structure of the mucro and claws. It has been taken at Mandurah, W. Aust, April 30, 1931; Crawley, W. Aust., May, 1931 (D. C. S.).

Brachystomella anomala, n. sp.

(Text fig. 5, *a-g.*)

Description.—Length, 2·5 mm. Colour, bluish-brown. Antennae slightly shorter than head, ratio of antennal segments I. : II. : III. : IV. = 10 : 10 :

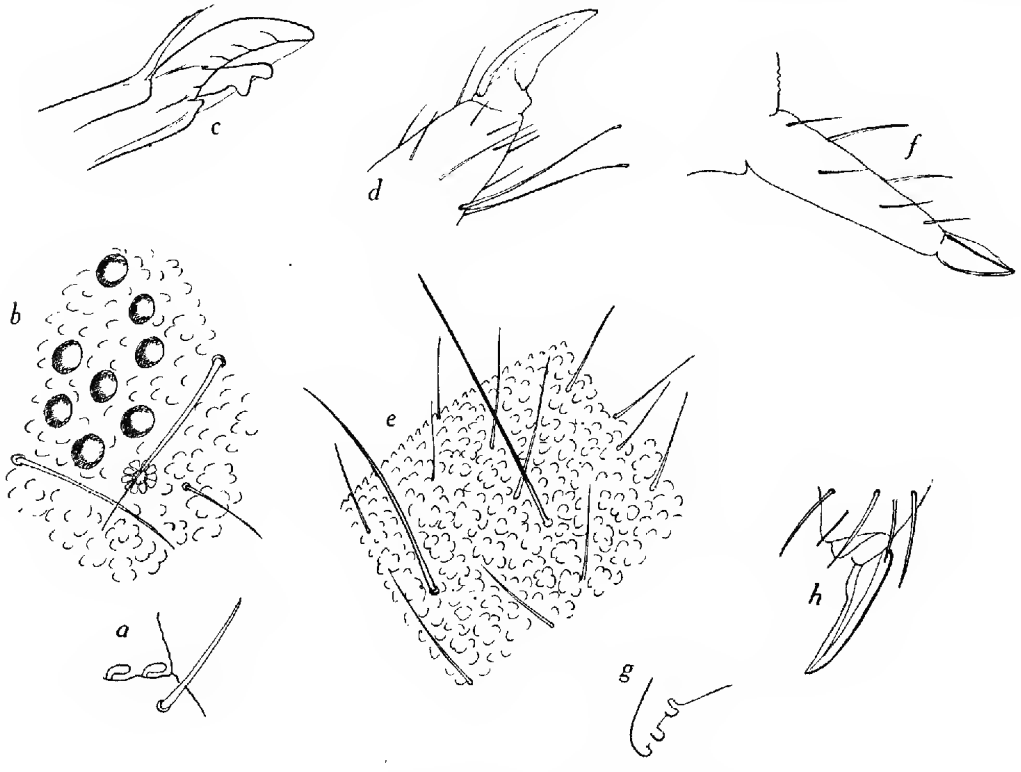

Fig. 5.

a. *Brachystomella anomala*, n. sp. Sensory organ of antennae III.
b. „ „ „ „ Ocelli and postantennal organ.
c. „ „ „ „ Head of maxilla.
d. „ „ „ „ Tip of tibiotarsus and claw.
e. „ „ „ „ Dorsal cuticle.
f. „ „ „ „ Dens and mucro from side.
g. „ „ „ „ Rami.
h. *Anurida granaria* (Nicolet). Claw.

10 : 11, IV. with small trilobed apical knob, olfactory hairs (?), organ on antennae III. indeterminate. Ocelli, 8 on each side, not on a pigmented field. Postantennal organ rosette-like, with 12 lobes. Mandibles absent, head of maxillae as in *Anurida* (text fig. 5, *c*). Claws without inner teeth. Empodial appendage absent. Tibiotarsal clavate hairs 2 on inner side, long. Furca well developed, dens granular and about three times as long as the mucro, mucro broad with simple inner lamella. Rami of tenaculum with 3 barbs. Cuticle strongly granular with numerous long, simple setae.

Described from four specimens from the following localities:—Sassafras, Vict., December, 1931 (H. G. A.), 3 specimens; Sherbrook, Vict., April 19, 1931 (H. G. A.), 1 specimen.

It is with considerable doubt that this species is placed in the genus *Brachystomella*. From other species of this genus it differs very definitely in the strongly granular structure of the cuticle, in this respect recalling that of *Anurida granaria* (Nicolet). Mandibles are wanting, but the complex head of the maxilla resembles that of *Anurida* rather than *Brachystomella*. The ocelli are 8 on each side, and not 5 as in *Anurida maritima* Guerin, or absent as in *A. granaria* (Nicolet). The postantennal organ also resembles that of the latter species. The furca is similar in structure to that of *Brachystomella parvula* (Schäffer).

In all probability this species will have to be placed ultimately in a new genus.

Genus Anurida Laboulbene, 1865.

Syn.=*Anoura* Nicolet, 1847 (ad partem); *Aphoromma* MacGillivray, 1893; *Anurida* Schött, 1893.

Anurida granaria (Nicolet), 1847.

(Text fig. 5, *h*.)

Aphoromma granaria MacGillivray, 1893.

Description.—Length, 1·8 mm. White. Ocelli absent. Postantennal organ present, rosette-like with 12-21 lobes. Antennae shorter than head. Antennae IV. with 8 olfactory hairs. Claws toothless. Empodial appendage absent or only represented by a small nodular piece without bristle. Hairs short and sparse. Cuticle with large granules.

This is a typical soil inhabiting species and most probably has been introduced into Australia. It has been found in material from Mount Lofty Ranges, Adelaide, S. Aust., November 17, 1931 (D. C. S.).

Genus **Neachorutes**, n. gen.

Description.—General facies as in *Anurida maritima* Guerin. Antennae 4-segmented, longer than head. Ocelli, 8 on each side on dark field. Postantennal organ absent. Furca long and simple, dens somewhat bowed in the horizontal, mucro small and not distinctly separated from dens. Mandibles present, strongly toothed apically but without molar area. Claws strong. Tibiotarsi without clavate hairs. Male with last abdominal segment strongly produced.

Genotype *Neachorutes glauerti*, n. sp.

Neachorutes glauerti, n. sp.

(Text fig. 6, *a-i*.)

Description.—Length of male, 3·0 mm.; of female, 2·4 mm. Colour, deep bluish-black. Antennae nearly twice as long as head, ratio of segments I. : II. : III. : IV. = 6 : 8 : 12 : 10. Ocelli, 8 on each side on a dark field. Postantennal organ absent. Clavate tibiotarsal hairs absent. Furca very well developed, long

and thin, especially the dentes which are slender, parallel-sided and highly granular. Mucro small, less than one-seventh of the length of the dens and with distinct lamella. Rami of tenaculum with 4 barbs. Clothing very sparse except on appendages, on apical antennal segments the setae are twice the width of segments, all setae simple. The adult male differs from the female in that the last abdominal segment is produced in an upturned manner, the prolongation being as long as the basal segment itself. The cuticle richly granular.

This genus and species is of littoral habitat and occurs under stones between high and low water marks. It can withstand immersion in a good depth of water, and is often taken in numbers in the crevices of rocks lying in several feet of water. From its habitat it can possibly be regarded as replacing *Anurida maritima* Guerin of the Northern Hemisphere in the Australian region.

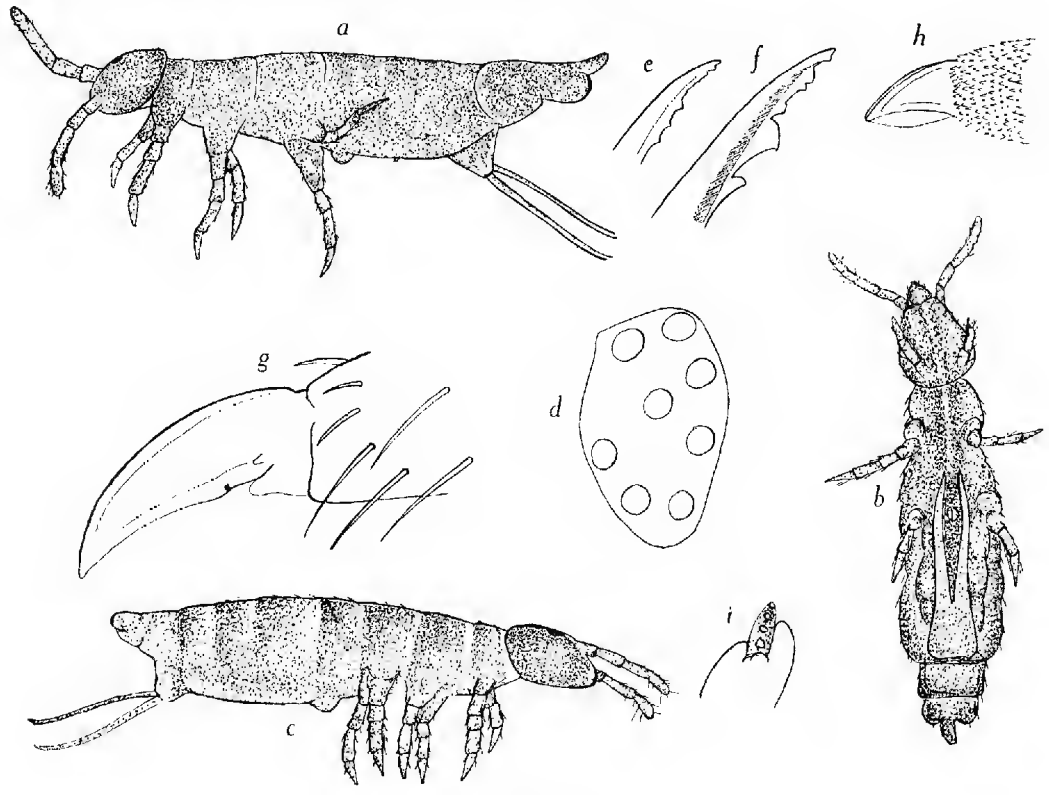

Fig. 6.

Neachorutes glauerti, n. g., n. sp.

a. Male insect, side view.
b. „ „ ventral view.
c. Female insect, side view.
d. Ocellar field.
e. Head of maxilla.
f. Head of mandible.
g. Tip of tibiotarsus and claw.
h. Tip of dens and mucro.
i. Rami.

It was first discovered by Mr. L. J. Glauert, of the Perth Museum, on Rottnest Island, Western Australia, in the described habitat, along with another interesting littoral species, *Axelsonia littoralis* (Moniez). The detailed localities are:—Longreach Bay, Rottnest Island, W. Aust., January 3-6, 1930 (L. J. G.); Fresh-

water Bay, Swan River, W. Aust., February 2, 1930 (Miss Horgan); Point Perron, W. Aust., 1931 (H. W.); Christy's Beach, S. Aust., January 17, 1931 (D. C. S.); Marino, S. Aust., March 24, 1929 (R. H.).

Genus ACHORUTES Templeton, Börner.

Syn.=*Achorutes* Templeton, 1835 (ad partem) ? *Blax* Koch, 1840; *Anoura* Gervais, 1842; *Anura* Tullberg, 1869; *Neanura* MacGillivray, 1893.

ACHORUTES ROSACEUS Schött, 1917.

Description.—Length, 1·5-2·0 mm. Colour, in life, rose; in spirit, white. Facies of typical *Achorutes* form. Cuticle uniformly tuberculate. Ocelli, 2 on each side on edge of head prominence. Postantennal organ absent. Antennae IV. with a trilobed organ. Claw toothless. Dorsal setae strong but simple.

This species was described by Schött from North Queensland in 1917 (226). In Western Australia it seems to be generally abundant and has been taken as follows:—Perth, W. Aust., October 4, 1930; Denmark, W. Aust., October 17, 1930 (H. W.); Margaret River, W. Aust., April 25, 1931 (L. J. N.); Mandurah, W. Aust., April 30, 1931 (H. W.); Mount Lofty Ranges, S. Aust., March 2, 1931 (H. G. A.).

ACHORUTES CIRRATUS Schött, 1917.

Description.—Length, 1·5 mm. Colour, in spirit, white. Cuticle in regular fields and prominences of tubercles. Ocelli, 2 on each side, not pigmented. Postantennal organ wanting. Antennae IV. with an apical trilobed organ. Claws simple. Setae on outstanding prominences of abdomen, large, strongly feathered but not clavate.

This species, also described by Schött from North Queensland, has been since found in the following localities:—Studley Park, Vict., August, 1931 (H. G. A.); You Yang Mountains, Vict., September 24, 1931 (Miss J. R.).

Achorutes newmani, n. sp.

(Text fig. 7, *d-e.*)

Description.—Length, to 3·0 mm. Colour, in life, creamy white. Antennae only half as long as head, segments subequal, IV. with 4 or 5 olfactory hairs, antennal organ III. inconspicuous and indeterminate. Ocelli, 3 on each side, without pigment, one placed sublaterally and subposteriorly on a prominence, the other two not on a prominence, their own diameter apart and four to five times their diameter from the anterior edge of the prominence on which is the other ocellus. The dorsal surface is highly tubercular and shows a number of prominences as is usual in this genus, as follows:—On head, three transverse rows, anterior one of two each with four strong setae, medial row of five, the three middle ones with 3 setae and the outer ones with 4, a posterior row of six, the middle four with 2 setae and the outer ones with 4 setae; thorax I., a row of six, the outer prominences with 1 setae, the others with 2 setae; thorax II., a row of six, outer ones with 4, others with 3 setae; thorax III., row of six as in thorax II; abdomen I., II., and III. with a row of six, median pair with 3 setae, mediolateral pair with 3 strong setae and 1 fine seta, ectolateral with 2 setae; abdomen IV. with row of six, medial pair with 2 setae, mediolateral with 2 strong and 1 fine setae, ectolateral with 3 setae; abdomen V. with row of four, median pair with 3 setae, outer ones with 3 strong and 1 fine setae; abdomen VI. with two prominences, each with 6 setae dorsally. Mouth organs small, needle-like, mandibles present without molar plate. Claws without inner tooth, but basal lateral teeth present, tuberculate almost to tip

of claw. Empodial appendage absent. Furca absent. Clothing of the strong, rather blunt and indistinctly ciliated setae as on the prominences.

This species is closely related to *A. zehntneri* Handschin described from Java. It differs in not having the carmine colouration in life of Handschin's species and in the absence of an inner tooth to the claw. The relative disposition of the ocelli is also distinctive. It is named in honour of the Government Entomologist of Western Australia, in whose company the writer was when he first found this species in large numbers under loose bark at Picton Junction, Western Australia, October 10, 1930.

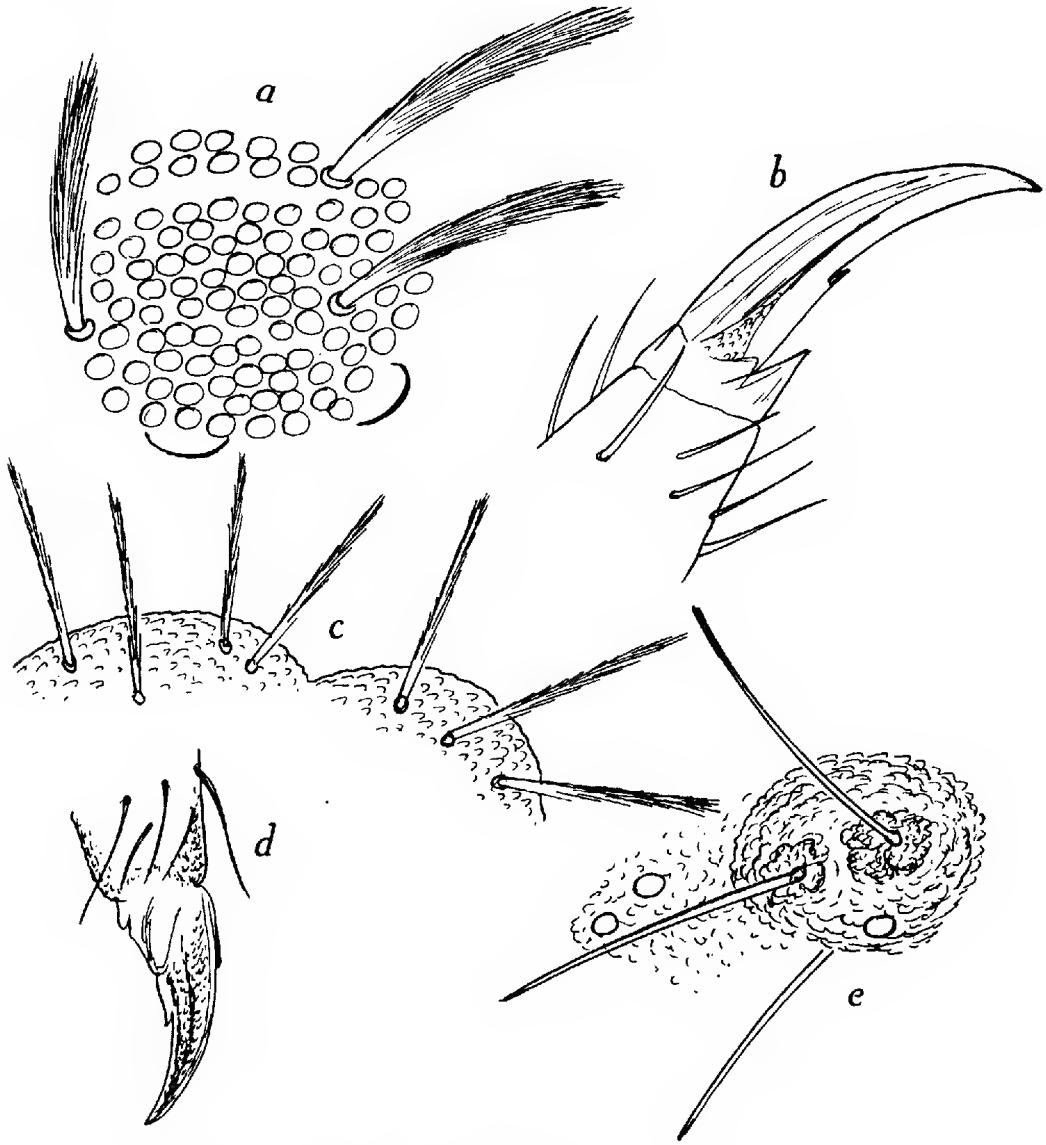

Fig. 7.

a. *Achorutes hirtellus* Börner. Ocelli.
b. „ „ „ Tip of tibiotarsus and claw.
c. „ „ „ Anal tubercles and setae.
d. „ *newmani*, n. sp. Tip of tibiotarsus and claw.
e. „ „ „ „ Ocelli.

ACHORUTES HIRTELLUS Börner, 1906.

(Text fig. 7, *a-c.*)

Description.—Length, 2·0 mm. In spirit, as in life, yellowish-white. Claw with ventral tooth. Ocelli, 2 on each side, unpigmented. Dorsal setae long, feathered and strongly clavate.

A single specimen taken at Sherbrook Falls, Victoria, April 19, 1931 (H. G. A.) is somewhat doubtfully referred to this species.

Family ONYCHIURIDAE Börner, 1913.

Syn.=*Aphorurinae* Börner, 1901; *Aphorurini* Börner, 1901; *Onychiurinae* Börner, 1901.

Genus ONYCHIURUS Gervais, 1841; Börner, 1901.

Syn.=*Podura* Linne, 1758 (ad partem); *Lipura* Burmeister, 1838 (ad partem); *Onychiurus* Gervais, 1841, in littoris; *Adicranus* Bourlet, 1843 (ad partem); *Anurophorus* Nicolet, 1841 (ad partem); *Aphorura* MacGillivray, 1893; *Protaphorura* Börner, 1909.

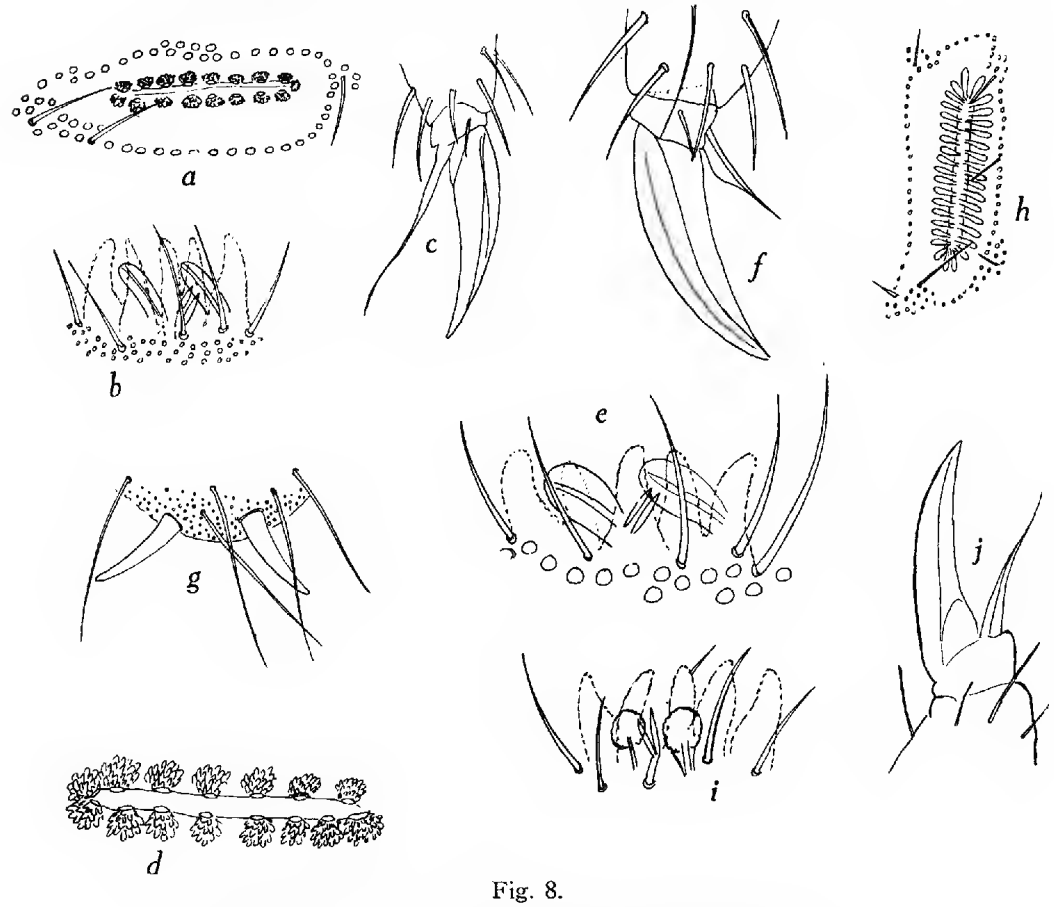

Fig. 8.

a.	*Onychiurus*	*fimetarius*	(Linn.)	Postantennal organ.
b.	„	„	„	Antennal sensory organ.
c.	„	„	„	Claw and tip of tibiotarsus.
d.	„	*ambulans*	„	Postantennal organ.
e.	„	„	„	Antennal sensory organ.
f.	„	„	„	Claw and tip of tibiotarsus.
g.	„	„	„	Anal spines.
h.	„	*armatus*	(Tullberg).	Postantennal organ.
i.	„	„	„	Antennal sensory organ.
j.	„	„	v. *denticulata*	Handschin. Claw.

Onychiurus fimetarius (Linne, Lubbock).

(Text fig. 8, *a-c.*)

Podura fimetaria Linne, 1766; *Lipura fimetaria* Lubbock, 1867; *Lipura inermis* Tullberg, 1869; *Lipura wrightii* Carpenter, 1895; *Aphorura inermis* Schäffer, 1896; *Onychiurus pseudofimetarius* Folsom, 1916.

Description.—Length, 1·5-2·0 mm. White. Sensory clubs of antennal organ III. smooth. Postantennal organ with 12-16 clusters of tubercles. Pseudocelli on antennae bases 2, behind 1. Claw toothless, small. Empodial appendage with bristle as long as claw. Anal spines wanting.

This is a common inhabitant of garden soils, and when it occurs in large numbers often does considerable damage. In Australia it has been found as follows:—In hot-houses, Government Gardens, Perth, W. Aust., November 18, 1930; ditto, February 13, 1931 (H. W.); Mount Lofty Ranges, S. Aust., November 7, 1931 (D. C. S.); Glen Osmond, S. Aust., April, 1932 (D. C. S.); on *Cortinarius,* sp., Neutral Bay, N.S.W., 1929 (J. B. C.); in S.A. Museum, without data; in green-house, Adelaide, March, 1933 (H. M. H.).

Onychiurus ambulans (Linne, Nicolet).

(Text fig. 8, *d-g.*)

Podura ambulans Linne, 1758 (ad partem); *Anurophorus ambulans* Nicolet, 1847; *Lipura ambulans* Lubbock, 1862; *Aphorura ambulans* MacGillivray, 1862; ? *Aphorura willemi* Börner, 1901.

Description.—Length, 2·0 mm. White. Antennal organ III. with smooth sensory clubs. Postantennal organ with 12-15 granular tubercles. Antennae bases with 2 pseudocelli. Claws toothless. Empodial appendage with basal lamella and bristle. Anal spines present, large and slightly curved, on smaller papillae.

This species is to be found in soil like the preceding one. It is very common in Europe where it exists in two forms, *O. ambulans* (Nicolet) *forma principalis*, with anal spines, and *O. ambulans* var. *inermis* Agren, without anal spines. It occurs commonly in most cultivated soils in the Perth area of Western Australia, but only the typical form has so far been found.

Onychiurus armatus (Tullberg), 1869.

(Text fig. 8, *h-j.*)

Lipura armata Tullberg, 1869; ? *Lipura fimetaria* Dalla Torre, 1888; *Aphorura armata* Reuter, 1898.

Description.—Length, 0·9-2·5 mm. White. Antennal organ III. with sensory clubs like bunches of grapes. Postantennal organ with 16-32 simple tubercles. Claws with or without teeth. Anal spines long, weakly curved, or papillae sometimes absent.

This is another common soil inhabitant in Europe. Owing to its attacking the rootlets of plants and killing them by sheer weight of numbers, it must be regarded as of economic importance. The variety without anal spines, var. *inermis* Agren, has not yet been found in Australia, but both the typical form and the variety *denticulata* Handschin, which has an inner tooth to the claw, have been found as follows:—*Forma principalis:* Government Gardens, Perth, W. Aust., February 2, 1932; in green-house, Adelaide, S. Aust., March, 1933 (H. M. H.). Var. *denticulata* Handschin: Mount Lofty Ranges, S. Aust., October 29, 1931.

Genus TULLBERGIA Lubbock, 1876.

Syn.=*Stenaphorura* Absolon, 1900; *Mesaphorura* Börner, 1901; *Börneria* Willem, 1902.

TULLBERGIA TRISETOSA (Schäffer) Börner.

(Text fig. 9, *a-c*.)

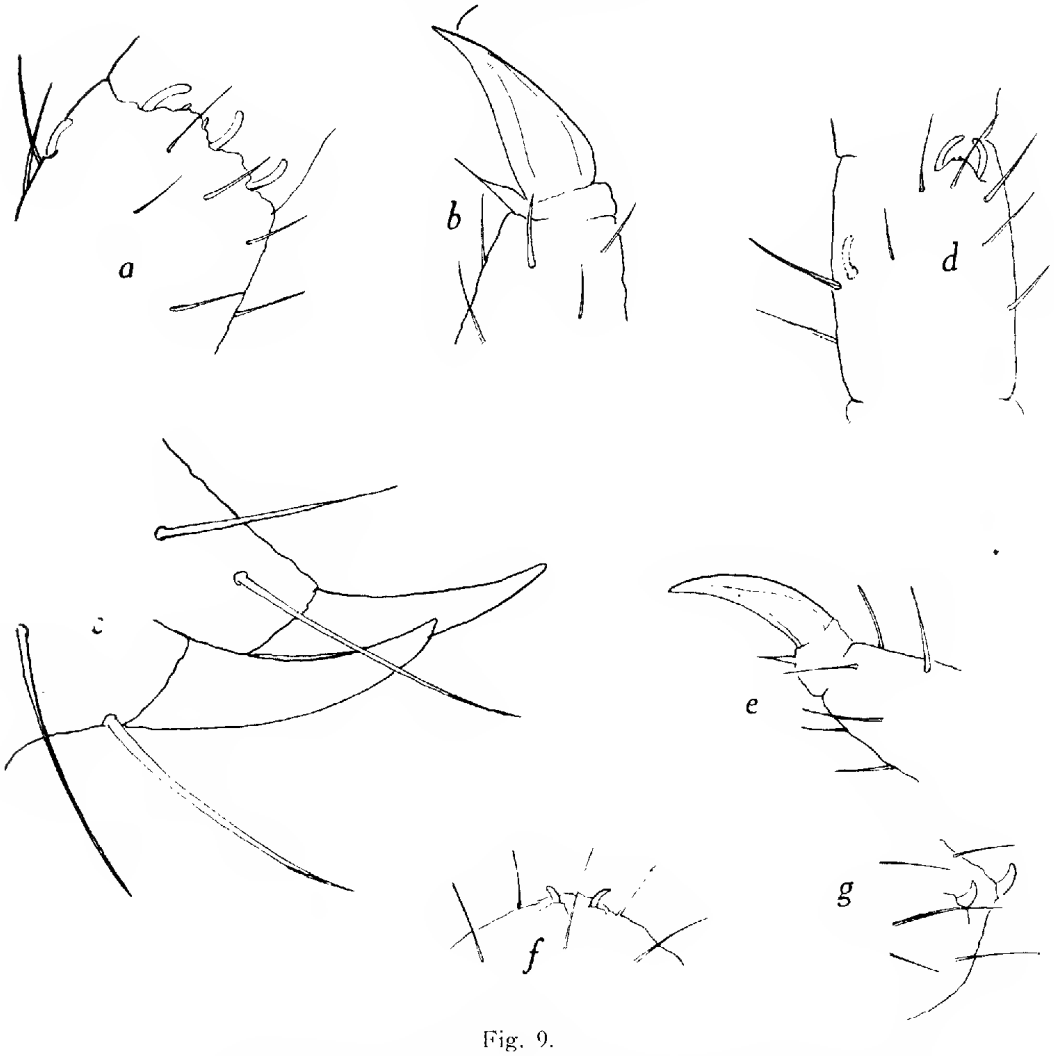

Fig. 9.

a. *Tullbergia trisetosa* (Schäffer). Sensory organ on antennae III.
b. „ „ „ Claw and tip of tibiotarsus.
c. „ „ „ Anal spines.
d. „ *australis*, n. sp.. Sensory organ on antennae III.
e. „ „ „ „ Claw and tip of tibiotarsus.
f. „ „ „ „ Anal spines from above.
g. „ „ „ „ „ „ „ side.

Aphorura trisetosa Schäffer, 1897; *Aphorura trisetosa* var. *quadrisetosa* Willem, 1902; *Börneria quadrisetosa* Willem, 1902.

Description.—Length, 1·4 mm. Colour, whitish-yellow. Antennae slightly shorter than the head, ratio of antennal segments I. : II. : III. : IV. = $7\frac{1}{2}$: $7\frac{1}{2}$: 11 : 12. IV. with 3 or 4 olfactory hairs. III. with sensory organ of 3 parallel-sided stout sensory clubs lying behind a layer or fold of the cuticle; between the two inner clubs is a pair of minute sensory rods; papillae apparently absent; on

ventral side of antennae III., at about the middle of the segment, is a fourth slightly curved and parallel-sided club. Antennae base marked off from the rest of the head by a smaller size of the cuticular tubercles. Claws strong, without inner tooth. Empodial appendage present with narrow inner basal lamella and apical bristle which almost reaches the middle of the claw. Clavate tibiotarsal hairs absent. Eyes absent. Postantennal organ long with 80-100 tubercles. Furca absent. Anal spines 2, long and slightly curved on papillae of almost their own length. Anal spines twice as long as the hind claws. Cuticle strongly granular. Clothing of fine and long setae, especially analwards. Pseudocelli = ant. base 1, base of head 1 plus 1, thorax I., II., and III., 1 plus 1, abdomen I.-III. 2 plus 2, IV.-V. 1 plus 1, VI. 0.

The Australian specimens which are referred to this species differ in the number of tubercles in the postantennal organ from the figures given by Börner (35). His number is 100, whereas in the material examined it is round about 80. The localities are:—Sherbrook Falls, Vict., April 19, 1931 (H. G. A. and H. F. D.); Belgrave, Vict., April 19, 1931 (H. G. A.); Mount Lofty Ranges, S. Aust., November 7, 1931 (D. C. S.); You Yang Mountains, Vict., September 9, 1931 (Miss J. W. R.); Specimens in the S.A. Museum (?), Adelaide, no other data.

Tullbergia australica, n. sp.

(Text fig. 9, *d-g.*)

Description.—Length, 0·9 mm. Colour, white. Antennae slightly shorter than head, ratio of segments I. : II. : III. : IV. = 4 : 4 : 6 : 7, IV. with 4 olfactory hairs, organ on III. with 2 strongly curved parallel-sided sensory clubs almost touching at their tips, and two minute rods. Ventrally on ant. III. there is also a third sensory club. Cuticular granules on antennae bases about the same size as those on the head. Ocelli absent. Postantennal organ with about 60 tubercles. Claws without inner teeth. Empodial appendage present with small inner lamella and terminal bristle which does not reach to more than one-third the length of claw. Clavate tibiotarsal hairs absent. Furca absent. Anal spines small, on small papillae not touching at the base. Pseudocelli large. Base of antennae with 1, base of head 1 plus 1, thorax I. to abdomen III. 1 plus 1, IV. 2 plus 2, V. 1 plus 1. Cuticle finely granular.

This species is very closely related to the European *T. krausbaueri* Börner, from which it differs in the presence of the third club on antennae III., in the number of lobes in the postantennal organ and in the number and arrangement of the pseudocelli. It has been taken as follows:—Crawley, W. Aust., October 2, 1930 (D. C. S.); November 19, 1930 (D. C. S.); April 16, 1931 (H. W.); Kalamunda, W. Aust., June 15, 1930 (D. C. S.); Sassafras, Vict., 1931 (H. G. A.).

KEY TO THE GENERA OF THE COLLEMBOLA-ARTHROPLEONA.

Superfamily PODUROIDEA.

A. Without pseudocelli. With or without ocelli. Sensory organ of antennae III. with rods but without sensory cones or outer papillae. Antennae IV. without subapical pit but always with retractile sensory knob.

1. Head hypognathus. Ocelli placed on hind part of head. Dentes bowed horizontally, annulated distally, over-reaching ventral tube. Manubrium resembling that of the Collembola-Symphypleona, with a special medial support piece of the dentes.

Family PODURIDAE Börner, 1906.

(A single genus and species *Podura aquatica* Linne, not known from Australia.)

II. Head obliquely prognathus. With or without ocelli, if present then on the front of the head. Dentes not annulated, fairly straight, seldom reaching ventral tube, or the furca more or less reduced. When present the furca is simple and without the medial support piece of the dentes.

Family HYPOGASTRURIDAE Börner, 1906.

(a) Mandibles with well-developed molar plate.

Subfamily HYPOGASTRURINAE Börner, 1906.

1. Postantennal organ absent. Ocelli, 5 or 4 on each side. Empodial appendage absent. Furca more or less reduced. Anal spines 2, usually very small.

Genus XENYLLA Tullberg, 1869.

Postantennal organ present.[1] 2

2. Postantennal organ simple, elliptical or indistinctly lobed. Empodial appendage absent. Anal spines absent or present.
Postantennal organ compound with peripheral lobes. 3

3. Ocelli absent. Postantennal organ simple, cordate. Mandibles without proximal portion, basally with a pair of hooks. Head dorsally with a pair of curved spines or hooks. Anal spines 2, as long as the claws. Empodial appendage absent.

Genus *Gomphiocephalus* Carpenter, 1908
(not Australian).

Ocelli present. Mandibles normal. Empodial appendage absent. Anal spines absent.

Genus *Schöttella* Schäffer, 1896 (including *Beckerella* Axels, 1912)
(not Australian)

4. Furca poorly developed. Ocelli absent. Postantennal organ with 4-6 lobes. Empodial appendage present. Anal spines 2, very small, often absent.

Genus *Willemia* Börner, 1901
(not Australian)

Furca well developed. Ocelli, 8 or fewer on each side. Postantennal organ with 4, seldom 7, lobes. Empodial appendage present or not. 5

5. Cuticle with large granulations. Furca well-developed but mucro small in relation to dens. Ocelli, 8 on each side. 6

Cuticle smooth or with only fine granulations. Ocelli, 8 or fewer.

Genus HYPOGASTRURA (Bourlet, 1839) Börner, 1906 (including subgenera *Schäfferia* Absolon, *Typhlogastrura* Bonet, *Mesachorutes* Stach, *Mesogastrura* Bonet, *Folsomiella* Bonet).

6. Anal spines 3, large and on large papillae. Empodial appendage rudimentary.

Genus *Triacanthella* Schäffer
(in New Zealand but not Australia).

Anal spines small, 2. Empodial appendage well developed.

Genus *Proxenyllodes* Denis, 1926
(not Australian)

(b) Mandibles entirely absent or without molar plate.

Subfamily ACHORUTINAE Börner, 1906.

(c) Anal segment with undivided supra-anal valve, with or without furca.

Tribe PSEUDACHORUTINI Börner, 1906

1. Anal spines present, although sometimes hardly larger than the cuticular granules.

Anal spines entirely absent. 4

2. Anal spines 4 or more, almost straight, papillae scarcely present.

Genus *Polyacanthella* Schäffer, 1900
(not Australian).

Anal spines 3, 1 behind 2 in front, occasionally 0 or 5, always curved and on distinct papillae. Furca reduced. Ocelli, 8 or fewer on each side. Empodial appendage absent.

Genus FRIESEA Dalla Torre, 1875.

Anal spines 2, sometimes small and little more than cuticular granules. Postantennal organ present. Ocelli, 5 on each side. 3

[1] Except in *Hypogastrura (Mesogastrura) coeca* Jonesco?

3. Empodial appendage present. Mucrones with normal lamellae Postantennal organ large, trilobed.
Genus *Xenyllodes* Axelson, 1903 (not Australian).

Empodial appendage absent. Mucrones with two consecutive lobes. Anal spines represented by two rather larger granules of the cuticle. Postantennal organ small, 4-lobed.
Genus Odontella Schäffer, 1897.

4. Eight ocelli on each side. 8
Fewer than 8 ocelli on each side. 5

5. Postantennal organ present. Ocelli generally present. 6
Postantennal organ absent. Ocelli, 2 or 3. Empodial appendage absent. Mouth-parts reduced.
Genus *Paranura* Axelson, 1902 (not Australian).

6. Mouth-parts very much reduced. Maxillae styliform without teeth. Empodial appendage absent. 7
Mouth-parts not so much reduced. Head of maxillae with teeth, not styliform. Ocelli, 5 on each side or absent. Empodial appendage present. 8

7. Ocelli, 1 on each side. Postantennal organ trilobed. Furca very much reduced, dentes and mucrones not differentiated. White, elongate.
Genus *Stachia* Folsom, 1932 (not Australian).

Ocelli, 2 or 4 on each side. Postantennal organ 6-20 lobed. Colour, bluish-grey or bluish-white.
Genus *Micranurida* Börner, 1901 (not Australian).

8. Mandibles with only a curved apical tooth and a subapical lobe-like expansion. Postantennal organ with 13-15 lobes. Ocelli wanting.
Genus *Anuridella* Willem, 1906 (not Australian).

Mandibles with many teeth and no lobe. Ocelli, 5 on each side or absent. 9
Genus Anurida Laboulbene, 1865.

9. Furca very long and slender. Dens many times (seven) as long as mucro. Antennae 3 times as long as head. Male with abdomen VI. produced. Ocelli, 5 on each side. Postantennal organ absent.
Genus Neachorutes, n. gen.

Furca much shorter or absent, when present of normal length. Antennae scarcely, if at all, longer than the head. 10

10. Species of flattened form with prominent pleural areas. 11
Species of normal build. 12

11. Furca present. Ocelli, 8 on each side. Postantennal organ half-elliptical with numerous lobes. Empodial appendage absent. Cuticle marked in hexagons. Body segments with cross furrows.
Genus Ceratrimeria Börner, 1906 (including *Linnaniemia* Philiptschenko, 1926).

Furca absent. Ocelli, 5 on each side. Postantennal organ circular with 12-13 lobes. Empodial appendage absent.
Genus *Platanurida* Carpenter, 1925 (not Australian, but occurs in New Zealand).

12. Mandibles absent. Ocelli, 8 on each side. Postantennal organ present or absent. Furca present or absent.
Genus Brachystomella Agren, 1903. (including *Guacharia* Jackson, 1927).

Mandibles present, styliform. Ocelli, 8 on each side. Postantennal organ present or absent. Furca present.
Genus Pseudachorutes Tullberg, 1892.

(d) Anal valve 2-lobed, broad. Abdomen VI. relatively large. Body generally with segmental tubercles. Postantennal organ of numerous cutaneous tubercles or absent.
Tribe ACHORUTINI Börner, 1906.

1. Body covered with numerous spines.
Genus *Holacanthella* Börner, 1906 (in New Zealand, not Australian).
Body not as above. 2

2. Sides of thoracic and abdominal segments produced backwards in long processes.
Genus *Acanthanura* Börner, 1906 (not Australian, but known from New Zealand).
Not as above. 3

3. Head of maxillae as in *Anurida* with a large-toothed head and 2-3 finely-toothed lamellae as well as a basal erect lobe, seldom without these. 4
Head of maxillae needle-like, without teeth or lamellae, at most at the base as in 4 with a tooth-like lobe.
Genus ACHORUTES Templeton, 1835; Börner, 1906.

4. Abdomen VI. hidden under V. Postantennal organ present, of numerous clustered lobes.
Genus *Morulina* Börner, 1906 (not Australian)
Abdomen VI. visible from above, not hidden under V.
Genus *Protanura* Börner, 1906 (not Australian).

B. With pseudocelli. With or without furca. Antennae with 2-3 sensory clubs, sensory rods, with or without papillae and protective setae. Antennae IV. mostly with subapical groove, seldom with retractile knob. Ocelli absent. Postantennal organ mostly present and well developed.
Family ONYCHIURIDAE (Lubbock, 1867) Börner, 1913.

1. The 2 or 3 sensory clubs of antennal organ III. smooth, curved towards one another, often an accessory club ventrally about the middle of the segment Ant. IV. with typical olfactory hairs. Postantennal organ with numerous simple lobes. Empodial appendage absent or bristle-like. Furca absent. Body long and narrow. 2
The 2 sensory clubs on antennal organ III. smooth or tuberculate, not curved towards one another. Postantennal organ of few or many simple or clustered tubercles or absent. Empodial appendage generally well developeed. Furca present or absent or rudimentary. Body broader and more robust. 3

2. Pseudocelli on body segments in the form of a rosette lying in a pit.
Genus TULLBERGIA Lubbock, 1876,
Pseudocelli consisting of two unequal, slightly curved rods lying in a pit. Lightly chitinised, brownish species.
Genus *Paratullbergia* Womersley, 1930 (not Australian).

3. Furca present, well developed with distinct manubrium, dentes and mucrones. Anal spines 4. Postantennal organ absent.
Genus *Tetrodontophora* Reuter, 1882 (not Australian)
Furca, when present, quite rudimentary. Postantennal organ present. 4

4. Cuticle with large granulations. Pseudocelli few, without a ring of chitin. Empodial appendage with basal lamella. Anal horns strong on large papillae.
Genus *Kalaphorura* Absolon, 1901 (not Australian).
Cuticle with numerous pseudocelli with distinct chitinous rings. No large cuticular granulations. Postantennal organ with simple tubercles or grape-like clusters. Furca absent or when present very rudimentary. With 4, 2 or 0 anal spines.
Genus ONYCHIURUS Gervais, 1842; Börner, 1901.

BIBLIOGRAPHY.

This will be given at the end of Part II. of the paper, which will deal with the Entomobryoidea.